

CHAPTER 15

CONSTRUCTION HOISTING AND RIGGING

EQUIPMENT REQUIREMENTS

This chapter outlines the requirements for the safe use of hoisting and rigging equipment on construction projects at DOE installations.

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15.1 GENERAL

- a. The versatility of hoisting and rigging equipment makes it extremely useful on construction projects. Improper and unsafe use, however, can result in serious accidents.
- b. This chapter outlines the requirements for lifting service on construction and demolition activities and provides references to other chapters of this Standard applicable to the use of hoisting and rigging equipment at construction projects on DOE installations.
- c. The following chapters of this Standard are applicable to construction hoisting and rigging operations:
 - 1. Chapter 1 “*Terminology and Definitions*,”
 - 2. Chapter 2 “*Critical Lifts*,”
 - 3. Chapter 4 “*Lifting Personnel*,”
 - 4. Chapter 7 “*Overhead and Gantry Cranes*,”
 - 5. Chapter 8 “*Hoists*,”
 - 6. Chapter 9 “*Mobile Cranes*,”
 - 7. Chapter 10 “*Forklift Trucks*,”
 - 8. Chapter 11 “*Wire Rope and Slings*,”
 - 9. Chapter 12 “*Rigging Accessories*,”
 - 10. Chapter 13 “*Hooks*,”
 - 11. Chapter 14 “*Below-the-Hook Lifting Devices*,”
 - 12. Chapter 16 “*Miscellaneous Lifting Devices*.”

15.2 PERSONNEL QUALIFICATIONS

15.2.1 QUALIFIED OPERATORS OF MOBILE CRANES

- a. Only qualified personnel or trainees, under the direct supervision of qualified personnel, who meet the following physical qualifications and requirements shall be allowed to operate mobile cranes:

1. Be at least 18 years of age.
2. Understand spoken and written English.
3. Have vision of at least 20/30 Snellen in one eye, and 20/50 in the other, with or without corrective lenses.
4. Be able to distinguish colors, regardless of position, if color differentials required for operation.
5. Have adequate hearing, with or without a hearing aid, for a specific operation.
6. Have physical strength, coordination, and sufficient reaction speed to meet the demands of equipment operation.
7. Show no evidence of physical defects or of emotional instability that could be a hazard to themselves or others, or which, in the opinion of the examiner, could interfere with their safe performance; such evidence may be sufficient cause for disqualification. In these cases, medical judgments and test may be required.
8. Show no evidence of being subject to seizures or loss of physical control; such evidence shall be sufficient reason for disqualification. Medical examinations may be required to determine these conditions.
9. Have normal depth perception, field of vision, manual dexterity, coordination, and no tendencies to dizziness or similar potentially hazardous characteristics.
10. Have no detectable or known disease or physical restriction that would render them incapable of safely operating

equipment. Where any deficiency of an upper or lower extremity exists, the acceptability of a candidate shall be the decision of the supervisor, after consulting with the designated physician.

11. Shall successfully pass with a negative result, a substance abuse test. The level of testing will be determined by the standard practice for the industry where the crane is employed and this test shall be confirmed by a recognized laboratory service.

12. Operator physical examinations shall be required every three years or more frequently if supervision deems it necessary.

- b. Prior to allowing mobile crane operations at DOE installations, the construction manager shall implement a program or ensure that the construction contractor has an acceptable program to evaluate crane operator qualifications. This program shall include written testing to evaluate operator knowledge and performance (“hands-on”) testing to evaluate operator skills. These tests shall include, but not be limited to applicable elements of the following:

1. Pre-use crane inspection.
2. The crane’s specifications, operator’s manual, charts (e.g., load charts, work area charts), instrumentation, controls, operator aids, and operating characteristics.
3. Operating procedures under emergency conditions.
4. Set-up, shut-down and parking of the crane.
5. Crane attachments (e.g., jibs, boom extensions, heavy lift equipment).
6. Configurations and loading effects on the crane.
7. Standards, rules and regulations (e.g., hand signals, distances for working around electrical power lines).

8. Rigging practices.

9. Personnel lifting procedures.

NOTE: The means of determining operator qualifications shall be included in the contract documents. Contract documents shall also include requirements for maintenance of testing records. Consideration should be given to local, state, or federal crane operator licensing requirements within the work jurisdiction as well as certification programs administered by recognized private organizations.

15.2.2 QUALIFIED OPERATORS OF FORKLIFT TRUCKS

- a. Physical qualifications shall be based on specific job requirements.
- b. Operators shall be required by the employer to pass a practical operating skill evaluation. Qualification shall be limited to the type of forklift for which the operator is being evaluated.
- c. The actual or simulated operation shall enable operators to demonstrate basic knowledge and skills at a level that ensures the safety of personnel and equipment.
- d. Only qualified and authorized operators shall be permitted to operate powered forklift trucks. Operator trainees may operate powered forklift trucks under the direct supervision of a qualified operator or trainer and only where such operation does not endanger the trainee or other employees.
- e. The initial training of operators shall include:
 1. A combination of formal instruction (e.g., lecture, discussion, interactive computer learning, video tape, written material).
 2. Practical training (demonstrations performed by the trainer and practical exercises performed by the trainee).
 3. Evaluation of the operator's performance in the workplace, including results of written and oral

evaluation, and witnessing a demonstration of the operator's skills.

- f. The following checklist contains basic factors with which a forklift truck operator should be familiar. This checklist must be tailored to suit actual conditions.
 1. Operating instruction, warnings, and precautions for the type of forklift truck the operator will be authorized to operate.
 2. Differences between the forklift truck and the automobile.
 3. Forklift truck controls and instrumentation:
 - i. Where they are located.
 - ii. What they do.
 - iii. How they work.
 4. Engine or motor operation.
 5. Steering and maneuvering.
 6. Visibility, including restrictions due to loading.
 7. Fork and attachment adaptation, operation, and use limitations.
 8. Forklift truck capacity and load weight determination.
 9. Forklift truck stability and load dynamics.
 10. Forklift truck inspections and maintenance that the operator will be required to perform.
 11. Refueling and/or charging and recharging of batteries.
 12. Operating limitations.
 13. Any other operating instructions, warning, or precautions listed in the operator's manual for the type of forklift truck that the employee is being trained to operate.

- g. The following checklist contains basic factors with which a forklift operator should be familiar as they relate to workplace topics.
 - 1. Surface conditions where the forklift will be operated.
 - 2. Composition of loads to be carried and load stability.
 - 3. Load manipulation, stacking, and unstacking.
 - 4. Pedestrian traffic in areas where the forklift
 - 5. Narrow aisles and other restricted places where the forklift will be operated.
 - 6. Hazardous (classified) locations where the forklift will be operated.
 - 7. Ramps and other sloped surfaces that could affect the forklift's stability.
 - 8. Closed environments and other areas where insufficient ventilation or poor vehicle maintenance could cause a buildup of carbon monoxide or diesel exhaust.
 - 9. Other unique or potentially hazardous environmental conditions in the workplace that could affect safe operation.
- h. Refresher training in relevant topics shall be provided to the operator when:
 - 1. The operator has been observed to operate the forklift truck in an unsafe manner.
 - 2. The operator has been involved in an accident or near-miss incident.
 - 3. The operator has received an evaluation that reveals that the operator is not operating the forklift truck safely.
 - 4. The operator is assigned to drive a different type of forklift truck.
- 5. A condition in the workplace changes in a manner that could affect the safe operation of the forklift truck.

15.2.3 QUALIFIED RIGGERS

Qualified riggers shall meet the following requirements:

- a. Be at least 18 years of age.
- b. Understand spoken and written English.
- c. Have basic knowledge and understanding of equipment-operating characteristics, capabilities, and limitations. Understand rigging principles as applied to the job for which they are to be qualified.
- d. Demonstrate to appropriate management personnel skill in using rigging principles.
- e. Be free of any detectable or known disease or physical restriction that would render them incapable of safe operating or rigging duties. Where any loss or loss of function of an upper or lower extremity exists, the acceptability of the candidate shall be the decision of the supervisor, after consulting with the designated physician.
- f. Have normal depth perception, field of vision, reaction time, manual dexterity, and coordination.

15.2.4 PERSON-IN-CHARGE (PIC)

The PIC shall have the necessary knowledge and experience of the specific type of equipment and the hazards of critical lifts to direct the safe completion of the operation. The PIC shall understand the rules and procedures implemented at the site to ensure that the following are completed:

- a. Necessary administrative requirements.
- b. Personnel assignments and responsibilities.
- c. Selection of proper equipment/tools.
- d. Recognition and control of hazardous or unsafe conditions.
- e. Job efficiency and safety.

- f. Critical-lift documentation.

In addition, the PIC shall:

- a. Direct operations in the case of an accident.
- b. Exercise authority to start and stop work activities.

15.2.5 DESIGNATED LEADER

The designated leader shall have sufficient knowledge and experience to accomplish the following responsibilities:

- a. Ensure that the personnel involved have received proper and current training and qualification for the procedure.
- b. Ensure that the equipment and accessories specified in the procedure are available.
- c. Survey the lift site for hazardous or unsafe conditions.
- d. Ensure that equipment is properly set up and positioned.
- e. Ensure that a signaler is assigned, if required, and is identified to the operator.
- f. Direct the lifting operation to ensure that the job is done safely and efficiently.
- g. Stop the job when any potentially unsafe condition is recognized.

- h. Direct operations if an accident or injury occurs.

15.2.6 INSPECTOR

- a. Qualified inspectors shall have the necessary knowledge and experience to properly inspect hoisting and rigging equipment.
- b. Employees who operate hoisting equipment to perform inspections shall be trained and qualified to operate the equipment on which the inspection is being performed
- c. Hoisting equipment operation by inspectors shall be limited to those equipment functions necessary to perform the inspection on the equipment.

15.2.7 MAINTENANCE PERSONNEL

- a. Employees who operate hoisting equipment to perform hoisting equipment maintenance shall be trained and qualified to operate the equipment on which maintenance is being performed.
- b. Hoisting equipment operation by maintenance personnel shall be limited to those equipment functions necessary to perform maintenance on the hoisting equipment or to verify the performance of the hoisting equipment after maintenance has been performed.

15.3 INSPECTION AND TESTING

- a. Only equipment that has been built to nationally recognized manufacturers' standards shall be used at DOE installations. Existing equipment shall be brought to an acceptable level of compliance as determined by the construction management contractor. In some instances, the inspection and testing requirements of referenced applicable chapters of this standard exceed those of OSHA/ASME and in such instances, the requirements of this standard shall prevail.
- b. Prior to being used at a DOE installation, mobile cranes/boom trucks/forklift trucks shall be inspected and approved for operation by appropriate construction management contractor personnel, or those having overall responsibility for ordinary hoisting operations.
- c. Equipment with deficiencies that may affect the safety of the operation shall not be allowed to operate at DOE installations. No repairs, modifications, or additions that affect the capacity or safe operation of the equipment shall be made by the contractor without the manufacturer's written approval. Where manufacturer's specifications are not available, the limitations assigned to the equipment shall be based on the determinations of a qualified engineer. Dated and signed records shall be kept on file.
- d. Mobile cranes, boom trucks, and forklifts that have left the control of the construction management contractor and are then returned shall be reinspected prior to making a critical lift.

15.4 OPERATION

15.4.1 GENERAL

The operational requirements of all chapters referenced in Section 15.1 “General” of this standard shall apply to construction hoisting and rigging operations.

15.4.2 WIRE ROPE SLINGS

For construction applications, eyes in wire rope slings, bridles, or bull wires shall not be formed by wire rope clips or knots (refer to 29 CFR 1926.251(c)(4)(ii)).

15.5 STEEL ERECTION

15.5.1 GENERAL

- a. The following hoisting and rigging requirements apply only to steel erection activities as described in 29 CFR 1926.750(a).
- b. In addition to the conditions listed under Section 2.1, a lift shall be designated as a critical lift if (1) the lift exceeds 75 percent of the rated capacity of the crane or derrick, or (2) the lift requires the use of more than one crane or derrick (refer to 29 CFR 1926.751).

15.5.2 DEFINITIONS

CONTROLLED LOAD LOWERING: Lowering a load by means of a mechanical hoist drum device that allows a hoisted load to be lowered with maximum control using the gear train or hydraulic components of the hoist mechanism. Controlled load lowering requires the use of the load hoist drive motor, rather than the load hoist brake, to lower the load.

MULTIPLE LIFT RIGGING: Rigging assembly manufactured by wire rope rigging suppliers that facilitates the attachment of up to five independent loads to the hoist rigging of a crane.

STEEL ERECTION: The construction, alteration or repair of steel buildings, bridges and other structures, including the installation of metal decking and all planking used during the process of erection.

15.5.3 PRESHIFT INSPECTION OF CRANES

- a. Cranes being used in steel erection activities shall be visually inspected by a competent person prior to each shift. The inspection shall include observation for deficiencies during operation. At a minimum this inspection shall include the following:
 1. All control mechanisms for maladjustments;
 2. Control and drive mechanism for excessive wear of components and contamination by lubricants, water or other foreign matter;

3. Safety devices, including but not limited to boom angle indicators, boom stops, boom kick out devices, anti-two block devices, and load moment indicators where required;
4. Air, hydraulic, and other pressurized lines for deterioration or leakage, particularly those which flex in normal operation;
5. Hooks and latches for deformation, chemical damage, cracks, or wear;
6. Wire rope reeving for compliance with hoisting equipment manufacturer's specifications;
7. Electrical apparatus for malfunctioning, signs of excessive deterioration, dirt, or moisture accumulation;
8. Hydraulic system for proper fluid level;
9. Tires for proper inflation and conditions;
10. Ground conditions around the hoisting equipment for proper support, including ground settling under and around outriggers, ground water accumulation, or similar conditions;
11. The hoisting equipment for level position; and
12. The hoisting equipment for level position after each move and setup.

- b. If any deficiency is identified, an immediate determination shall be made by the competent person as to whether the deficiency constitutes a hazard.
- c. If the deficiency is determined to constitute a hazard, the hoisting equipment shall be removed from service until the deficiency has been corrected.
- d. The operator shall be responsible for those operations under the operator's direct control. Whenever there is any doubt as to safety, the operator shall have the authority

to stop and refuse to handle loads until safety has been assured.

15.5.4 QUALIFIED RIGGER

A qualified rigger shall inspect the rigging prior to each shift.

15.5.5 LIFTING PERSONNEL

The headache ball, hook or load shall not be used to transport personnel except as provided in Chapter 4 “*Lifting Personnel*.”

15.5.6 SAFETY LATCHES

Safety latches on hooks shall not be deactivated or made inoperable except when a qualified rigger has determined that the hoisting and placing of purlins and single joists can be performed more safely by doing so or when equivalent protection is provided in a site-specific erection plan.

15.5.7 WORKING UNDER LOADS

- a. Routes for suspended loads shall be pre-planned to ensure that no employee is required to work directly below a suspended load except for:
 1. Employees engaged in the initial connection of the steel; or
 2. Employees necessary for the hooking or unhooking of the load.
- b. When working under suspended loads, the following criteria shall be met:
 1. Materials being hoisted shall be rigged to prevent unintentional displacement;
 2. Hooks with self-closing safety latches or their equivalent shall be used to prevent components from slipping out of the hook; and
 3. All loads shall be rigged by a qualified rigger.

15.5.8 MULTIPLE LOAD LIFTS

- a. A multiple load lift shall only be performed if the following criteria are met:

1. A multiple lift rigging assembly is used;
 2. A maximum of five load members are hoisted per lift;
 3. Only beams and similar structural members are lifted; and
 4. All employees engaged in the multiple load lifts shall be trained in the following areas:
 - i. The nature of the hazards associated with multiple lifts
 - ii. The proper procedures and equipment to perform multiple lifts as required in this section.
 5. No crane is permitted to be used for a multiple load lift where such use is contrary to the manufacturer’s specifications and limitations.
- b. Components of the multiple lift rigging assembly shall be specifically designed and assembled with a maximum capacity for total assembly and for each individual attachment point. This capacity, certified by the manufacturer or a qualified rigger, shall be based on the manufacturer’s specifications with a 5 to 1 safety factor for all components.
 - c. The total load shall not exceed:
 1. The rated capacity of the hoisting equipment specified in the hoisting equipment load charts.
 2. The rigging capacity specified in the rigging rating chart.
 - d. The multiple lift rigging assembly shall be rigged with members:
 1. Attached at their center of gravity and maintained reasonably level;
 2. Rigged from top down; and
 3. Rigged at least 7 feet (2.1 m) apart.

4. The members on the multiple lift rigging assembly shall be set from the bottom up.
5. Controlled load lowering shall be used whenever the load is over the connectors.